

**Rethinking innovation and development:
Insights from the System of Rice Intensification (SRI) in India**

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Abstract

Sustaining innovation for development requires rethinking the notion of the poor as passive beneficiaries of the products of others' innovation. Recent thinking in development studies and in the literature on innovation points to the need for the poor to be active participants in the innovation process, a view that has independently gained ground through grassroots innovation networks. This paper looks at the evolution of a commons-based agricultural innovation – the System of Rice Intensification in India, to show how a systemic approach to innovation could benefit not just the poor but all the actors in an innovation system. This, however, requires institutional changes and a reconfiguration of agricultural research that would enable knowledge flows between research and non-research actors. Building innovation capacity in the system through a learning focus on actors and their institutional innovations and relating to the poor as users in user-centric approaches are suggested as ways forward.

Keywords: knowledge commons, pro-poor innovation, institutional learning, system of rice intensification, innovation as process

Introduction

There have recently been some changes in thinking on the relation between innovation and development in developing countries. From an earlier view of the poor as being passive beneficiaries of products of innovations being developed for them by the state or being promoted through the market, there is an emerging belief that the poor need to be proactively included in innovation processes to promote greater ownership and use of products. This reorientation has come from several fronts. First there is the critique of

development policies based on broader notions of development that goes beyond narrow economic definitions. A second impetus comes from networks of grassroots innovators who have sought alternative pathways to innovation, and a third from recent application to developing countries of new thinking about innovation in terms of “innovation systems.” Together, these views point to more incisive ways of thinking and provide insights into the question how the poor can innovate and be better assisted to innovate? What is needed for enabling innovation that is pro-poor? How should organizations such as the government and donor agencies, research organizations, private sector firms and non-governmental organizations respond to these challenges? How should the institutions that govern the relations between research and non-research actors be transformed if innovation is to benefit the poor?

This paper seeks answers to these questions through a case study of introduction of the System of Rice Intensification (or SRI) in India. It has three parts. In part one, I provide an overview of the academic debates on innovation and development and also the emerging grassroots perspectives on innovation. In part two, I look at the evolution of SRI in India in recent times, an innovation that has evolved quite independently of governmental policies and private sector involvement, but has shown considerable promise in providing innovative pathways to the solution of the connected problems of stagnating rice yields, declining soil fertility and inadequate incomes for rice farmers. SRI also presents a strong case for a rethinking of the role of the poor in innovation for development. In part three, I discuss some of the insights on innovation that the history of SRI presents and relate them to contemporary discussions in the innovation literature on open-source technology and the role of users in democratizing innovation. SRI, I argue, challenges us to rethink conventional paradigms on innovation and development, and it further demands that the resource-poor farmers in South Asia be provided the same status as users in the innovation process as is being increasingly promulgated in the innovation literature. Innovation policies, I argue, should continue to be premised on governmental involvement and support, and yet proactively change perceptions about the poor as passive beneficiaries of technological products and processes developed elsewhere. Creating a culture of innovation should in fact start by a recognition of the capacities and initiative of users and allow the

other actors in the system to interact in a manner that enables knowledge flows. The role of informal networks and knowledge brokers in enabling innovation is also highlighted through the case.

I. Development theory, grassroots innovation and the poor

An important trend in development literature is the focus on development as responsible well-being. This has pointed to individual agency both for the development practitioner as well as the poor. Development discourse has moved from “benevolence for welfare” to “participatory dialogue for partnership” and a “rights-based discourse for empowerment.” Development, it is suggested, needs to be understood as a myriad of organizational, collective and individual actions, and struggles for greater equity in human relations at global and local levels (Eyben and Lovett, 2004). The idea that development processes are now approached as a "complex system" indicates that poverty reduction has been hindered more by lack of institutional change that includes bureaucratic procedures and power relations, than by lack of funds (Groves and Hinton, 2004). Development as responsible well-being (Chambers, 2006) places the onus on development practitioners to be reflective and to view the relationship of aid providers to recipients as reciprocal and the imperative of providing space for agency. Others have been critical of the dominant view of development as a solely rational, linear, problem-solving exercise and instead suggested the more conscious need to learn from the positive (Biggs, 2007).

Echoing these views is the thinking on innovation, especially in the Indian context, from networks of grassroots innovators such as the Honey Bee Network (HBN) that nurtures innovation among India’s poor. Established in the late 1980s, HBN identifies grassroots innovations and traditional knowledge in India, and shares this knowledge with the innovators themselves through documentation and dissemination in different regional languages. Based on a philosophy that believes that the large mass of poor people often have no choice but to be inventive in order just to survive, the network comprised of concerned academics, and civil society organizations and grassroots innovators argues the case for treating the poor with dignity. They are knowledge rich but economically poor

people. The network believes that this pervasive potential for creativity and innovations by farmers, artisans, pastoralists, fishermen and women, and forest dwellers, has never been insufficiently tapped in public policies. The state institutions that have taken on the role of spearheading economic growth and scientific research in developing countries such as India have not developed the capability to scout, much less spawn experimentation and innovations at the grassroots (Gupta, 1996).

The network seeks to create a more equitable and transparent system that would benefit the innovators through people-to-people learning so that the benefits of innovation could accrue to the innovators. Over the years the network has grown to investigate and document over 10,000 grassroots innovations, some of which have been commercialized and scaled up. The network has grown considerably in recent times, and a separate National Innovation Foundation was founded to award innovators and help transform those innovations that have economic potential into products that can be commercially produced (either by the innovators themselves or through licensing the innovation to other commercial enterprises), plus linking grassroots innovators to the formal science and technology system to get inputs to improve upon innovations wherever necessary (Krishnan, 2005). The work of networks such as the Honey Bee Network address frontally the question of whether the poor can innovate, and they map out a role for civil society organizations and networks in promoting pro-poor innovation and development.

Critical thinking on development has also been reflected in much recent innovation literature that regards innovation as a process in more systemic terms. Thinking on innovation, especially in relation to agriculture, has been shaped by diffusion studies (Rogers, 1983) on the adoption and diffusion of hybrid corn in the United States in the 1950s. The idea of a linear progression from research scientists to extension workers and finally to farmers has been the paradigm for the organization of agricultural research and development in most parts of the world. An outcome of the model has been the separation of technology development (research) from technology transfer to farmers (extension), with separate respective organizations and mutually exclusive roles. This linear or pipeline model, while initially contributing to an increase in food supplies, especially during the

Green Revolution starting in the late sixties, has since come under critical scrutiny from several scholars for its failure to appreciate the multiple sources of innovation (Biggs, 1990), the nature and dynamics of innovation particularly in developing countries (Roling and Engel, 1992), and for its failure to provide sufficient attention to the distributional or equity aspects related to innovation (Hall et al., 2001).

The concept of innovation systems provides an alternative framework to look at innovation processes from a systemic perspective. The origins of the innovation systems concept lie in the concept of a national innovation system (Freeman, 1987; Lundvall, 1992). This concept emerged because conventional economic models that viewed the process as linear and research-driven had limited explanatory power. The innovation-systems framework sees innovation in a more systemic, interactive and evolutionary way, whereby networks of organizations, together with the institutions and policies that affect their innovative behaviour and performance, bring new products and processes into economic and social use (Lundvall, 1992; Edquist, 1997). The framework is now being used to understand and strengthen innovation at national, regional, and sectoral levels (OECD, 1997; Mytelka, 2000), including agriculture (Hall et al., 2001; Berdegue, 2005).

Innovation is now understood as a process that involves linkages and feedback between the main actors, and iterative processes of learning and reframing of approaches and research questions (Clark et al., 2003). Innovation capacity involves understanding institutions or habits and practices that govern interaction, learning and sharing knowledge among actors, the dynamic nature of changes among actors, and institutional innovations that reflect learning and capacity to cope with change (Hall and Dijkman, 2006).

II. Complex evolution of SRI in India

Debates on transgenic innovations in biotechnology and their potential effect on the poor in developing countries are highly contested and so polarized that credible alternatives that can meet some of the stated objectives of food security and environmental sustainability are often ignored. The SRI is one such alternative that has increased rice yields on farmers'

fields in over 25 countries and yet does not figure as part of the strategy of several international agricultural research organizations and aid agencies. Many of them continue to be sceptical of SRI despite increasing evidence that SRI methods raise the productivity of land, labour, water and capital concurrently (Uphoff, 2007). Part of the reason for this lack of acceptance is the politics of knowledge and the way that innovation has been understood. SRI, as I shall show, reverses much of the linear model of innovation discussed earlier and pushes us to seriously rethink the innovation process in developing countries.

Discussions on the politics of knowledge have escaped many discussions on SRI that have overwhelmingly focused on the yield potential and actual results of SRI. Some of these debates have been termed “Rice Wars.” (<http://www.i-sis.org.uk/RiceWars.php>). SRI as an alternative was ignored in discussions on improving rice productivity in the International Year of Rice 2004, and continues to be disregarded in discussions and serious consideration in programmes such as Challenge Programme on Water and Food of the Consultative Group on International Agricultural Research.

SRI is a civil society innovation that was first developed in Madagascar by Father Henri de Laulanié, a French Jesuit priest who combined field observations of rice plant performance with a series of experiments over a decade plus an accidental early planting. The new set of practices greatly improved the growing environment for rice plants, evoking more productive phenotypes from all rice genotypes on which the practices were used. The fact that this innovation occurred outside the formal research system or the private sector is noteworthy and actually challenges linear conceptions of research and innovation.

SRI is a system of growing rice that involves principles that are at times radically different from traditional ways of growing rice. It involves the careful transplantation of single young seedlings instead of the conventional method using multiple and mature seedlings from the nursery. SRI spaces rice plants more widely and does not depend on continuous flooding of rice fields, uses lesser seed and chemical inputs, and promotes soil biotic activities in, on and around plant roots, enhanced through liberal applications of compost and weeding with a rotating hoe that aerates the soil. These changed practices with lower

inputs counter-intuitively lead to improved productivity with yields of 7-8 tonnes per hectare (t/ha) – about double the present world average of 3.8 t/ha (Lines and Uphoff, 2005; Uphoff, 2007).

SRI in India: Slow Start and Rapid Spread

India is one of the largest producers of rice in the world; however, rice cultivation in recent times has suffered from several interrelated problems. Increased yields achieved during the Green Revolution through input-intensive methods of high water and fertilizer use in well-endowed regions are showing signs of stagnation and concomitant environmental problems due to salinization and water-logging of fields (the grain bowls of India Punjab and Haryana are some of the worst-affected). In other parts, there have been social conflicts between water users in several canal-irrigated areas due to the water-intensive nature of the crop.

The introduction of SRI as an alternative in India was, unlike other rice-growing nations, rather delayed, and yet India today has one of the largest number of SRI farmers in the world. The story of SRI in India indicates the complex evolution process of innovation and development. Official records indicate the first trials were started in 2000 at the Tamil Nadu Agricultural University (TNAU), Coimbatore as part of an international collaborative project. The results reported at the international SRI conference in 2002 indicated considerable water saving through modified SRI and a reduction of seed costs, but no significant increase in yields. These initial results would have been sufficient reason for rejecting SRI as an option for rice production in India; however, choices made by farmers and others are often complex than mere economic and productivity considerations.

The story of SRI can be seen in two parts: first, the official reading by the research and extension departments; and second, a more complex evolution with civil society activities and innovations throughout the period. Placing these two almost parallel developments in an innovation timeline reveals how innovations often have multiple sites and involve

multiple actors who are frequently unaware of each others' work. Thus, in India even as research trials were first conducted in the southern states of Tamil Nadu and Andhra Pradesh, the spread of the innovation has often gone much beyond the two states and reveals much diversity in the diffusion of innovation. In India today, SRI is practiced in over sixteen states, representing not only varied agro-ecological zones, but also varied combinations of civil society organizations (that include farmers' groups and non-governmental organizations or NGOs), universities, and state research and extension agencies. In fact, in some states like Tamil Nadu, SRI is referred to by different names by the state agricultural department and research organizations, on the one hand, and by civil society groups, on the other.

A detailed history of the complex evaluation of SRI (Shambu Prasad, 2006) indicates that some [not many!] civil society organizations attempted SRI as early as 1999, before the official trials by the government in 2000 and the beginning of SRI's rapid spread in 2003. These organizations and individuals accessed knowledge from diverse sources that included a Cornell alumni network, personal e-mails to and from Norman Uphoff at Cornell, and communication among international organic agriculture groups. The spread of SRI outside of Madagascar started around the same time through the efforts of Norman Uphoff, the innovation proponent of SRI, who was at the time director of the Cornell International Institute for Food Agriculture and Development (CIIFAD). After initial scepticism, observing farmers' success in Madagascar with the new methods, quadrupling average yields without changing varieties or relying on purchased inputs, utilizing training by Association Tefy Saina (ATS) – the NGO that Henri de Laulanié established in 1990 with Malagasy colleagues – Uphoff used his Cornell base to promote the evaluation and dissemination of SRI in rice-producing countries around the world. While no estimates have been made of the investments involved in spreading the innovation, the remarkable spread of SRI in just seven years, to get SRI validated in 28 countries, presents a case study in itself on the potential of knowledge in the creative commons. Not all innovations emerging from the grassroots might show the same potential as SRI, yet SRI is a good example of the possibility.

Civil society groups tried SRI in India with mixed results. The innovation of SRI was very knowledge-intensive, and it is an instance of where technology or practice precedes full scientific understanding of why SRI works. The response of denial, defensiveness and even antagonism of much of the rice research establishment in relation to SRI is in part because of the counter-intuitive nature of SRI and its challenge to conventional understanding of rice science. Ideally, an open culture of science would have prompted investigation, especially considering the multiple benefits reported for SRI methods; but, unfortunately, the initial reaction of a majority of rice scientists was an early closure of scientific interest as witnessed in what have been dubbed “the rice wars” (Surrige, 2004). Luckily, in India, there are scientists like T. M. Thiyagarajan in Tamil Nadu and Alapati Satyanarayana in Andhra Pradesh, who were willing to go beyond the confines of their received wisdom and investigate the SRI phenomenon and even contribute to the scientific debates of “the rice wars,” (Satyanarayana, 2004). Openness to knowledge irrespective of its source is evident from the example of Dr. Satyanarayana discussed below.

Satyanarayana was a doubter of SRI who later became one of its active and prominent proponents. Sent to Sri Lanka by the state government to learn about SRI’s potential in January 2003, the sceptical Satyanarayana’s accidental brush with a rice plant leaf that cut the skin of his finger got him thinking. This had not previously happened to him, though he had drawn his finger across rice leaves thousands of times before. He suddenly realized the difference in the rice plants he was observing, and he appreciated what he could learn about them by interacting with the farmers who had taken up these new methods, producing newer and better phenotypes. He subsequently reworked for himself the principles that led to the healthy growth of rice plants in SRI, and then developed an easy-to-understand package of practices for farmers of Andhra Pradesh. The reworking of knowledge that began in Sri Lanka later led to the co-creation of knowledge when he extensively toured farmers’ fields in the delta regions of Andhra Pradesh.

In one such instance, Jagga Raju, a farmer involved in seed production had started producing rice plants even in well-drained flower pots with extensive tillering, even >200 tillers. Raju had empirically shown that rice is not an aquatic plant, and Satyanarayana’s

interaction with Raju provided the farmer with scientific justification for his practices even as it built the confidence of the researcher in the emerging knowledge of SRI. The possibilities of co-creation of knowledge through interactions between different actors of the system would not have been possible in the linear conception of knowledge that comes from research scientists and flows to farmer through extension services.

The innovation history of SRI in India provides several insights such as the one above, and has been documented elsewhere (Shambu Prasad, 2006). Being open to the process of innovation shows several such encounters or meetings of research and non-research actors in a dynamic and continuously evolving SRI innovation system. SRI innovations in India have been led by civil society groups with extensive farmer innovations in implements such as weeders and markers as well as in the practices of SRI. The widespread experimentation and innovation by farmers have contributed greatly to the improvement of the practices even as it has presented several institutional challenges.

Few innovations have sparked such enthusiasm among farmers as SRI has in recent times. Organic farmers and groups have taken a lead in these experimentations as they are used to knowledge-intensive, as opposed to input-intensive practices. Even if their initial experiments have not always been successful, their understanding of SRI as a system of principles and not as a technology that is invariant for all soil or agro-ecological conditions has been significant. One of the earliest SRI experimenters Selvam Ramaswamy remarked that “SRI encourages farmers to think, whereas the Green Revolution treated them like children who needed to be taught.” Another widely respected organic farmer, Narayan Reddy, sees SRI as an “innovation of his lifetime” even as he continues to improve on the processes by introducing practices such as direct-seeding to SRI.

Another interesting feature of SRI has been the interest of extension agencies. There are instances of extension having led research, given that research agencies have been slow to investigate SRI. The contribution of insights on SRI from extensionists, farmers and researchers from outside the rice research establishment, notably soil microbiologists and entomologists have contributed considerably to SRI practices in India, and has in fact

created conditions for interest from the rice research establishment. Similarly, there has been greater interest from the irrigation department than the department of agriculture in many states. The last few years have seen a significant spread of SRI. While no data is available on the number of farmers who have tried out SRI, even a very conservative estimate would put this figure well over 150,000. Recent estimates in the small state of Tripura in the North East alone had SRI practiced on 14,000 hectares with active governmental support for about 70,000 small farmers. As SRI continues to spread it is likely to bring several institutional challenges in its wake.

Institutional challenges in scaling up the innovation

Enhancing knowledge-intensive innovations requires closer attention to institutions or the norms, rules and patterns that govern behaviour of actors in an innovation system. The number of actors in the SRI innovation system is continually increasing with each cropping season and its spread across newer regions. Even speaking of a national SRI innovation system or policy seems difficult in the Indian context, considering the wide variation across the states. Local SRI participants continually shape the system through interaction with others inside and outside their regional systems. Multiple actors often have different agendas as witnessed by the differential naming of SRI in the case of Tamil Nadu, where organic farmers chose a name epitomizing organic production whereas the state-agency term was compatible with external inputs. Habits or practices and institutions play important roles in these variations, and these reflect in the way SRI is understood and disseminated. Organic groups see SRI as a potentially important tool in their spread of non-chemical agriculture, even as extension agencies grapple with having to rework their systems to include bio-fertilizers and organic manure in their otherwise predominantly chemical agro-inputs package for farmers.

Habits and practices also influence the choice of area for SRI trials. Civil society groups have a stronger poverty-reduction focus, and are keen to extend SRI to small and marginal farmers, whereas the tendency of state agriculture departments has been to work with progressive and often richer farmers. The eagerness to demonstrate success has often meant

the push for high and even super-yields, whereas there are instances where civil society groups have presented the innovation with quite different meanings. An example is a reservoir irrigated area in dryland Anantapur district of Andhra Pradesh. Here in a particular season, thanks to the efforts of a civil society group, Timbaktu Collective that was actually working mostly on millets, farmers who were facing a loss of their standing crop could save it through application of some, but not all, of the SRI principles. Narayana Reddy, an organic farmer, communicated with them, and one institutional innovation was that the NGO provided learning for farmers and female labourers right on Reddy's farm. Farmers agreed to organize themselves for alternate wetting and drying of their fields, and this could reclaim their crop. The philosophy of intervention was not aimed at achieving super-yields, but at providing an option where none existed before. Even harvesting one tonne per hectare through SRI methods has meaning in such contexts among very poor and vulnerable farmers.

The fact that innovation actors provide multiple meanings for an innovation is often missed in the innovation literature which seeks to reduce the complexity of the innovation process to economic evaluations alone. It is often not sufficiently appreciated that diffusion of innovations involves complex meaning-creation and negotiations by the actors involved. Interventions also emphasize philosophies of innovation. SRI can be seen as a technology or package of practices that gets diffused, like improved varieties, from researchers to extension personnel to farmers with early adopters and then becomes pervasive; but, it can also be seen as a system (not a technology) that is based on the philosophy of farmer experimentation establishing locally sustainable practices *and* sharing what they learn with others, leading to its wider diffusion in an evolved form, not just replicating what researchers advised.

The emphasis and premium knowledge sharing is very high and has been behind the success of SRI spread, whether by researchers, NGOs or farmers. It provides a context and a culture that could shape the nature of participation of the private sector that is currently low. Options include greater involvement of the rice millers, promoters of bio-pesticides

and bio-fertilizers as well as agencies looking for added value in their profile, such as producing and conserving traditional and aromatic varieties of rice through SRI.

As a system that is still evolving, SRI faces several challenges in India as it moves toward improving knowledge-intensive innovation. Critical to the up-scaling of the innovation is the attitude to learning. As a case where technology has preceded science, issues relating to the appreciation of the role of rice plant roots and soil microbial activity need greater scientific investigation. Field-level results continue to raise numerous research questions, indicating sufficient scope for research not just in rice but also in other crops such as minor millets. Critical to the success of these investigations, however, is a consensus on the axioms of investigation as SRI principles are very different. Past results of on-station trials with SRI by rice scientists have often not matched the success achieved with the new methods in farmers' fields. This reversal, where researchers cannot replicate farmers' results, puts the standard research-extension paradigm in a bind.

Learning, adaptation, innovation, diversity, and system – these seem to be the key words in SRI. All of them require a different framework for understanding – a framework that goes beyond traditional understandings of “transfer of technology.” Reconfiguring agricultural research seems to be the greatest challenge if SRI and other pro-poor innovations are expected to make headway. In the traditional linear model according to which most agricultural research is organized, there is a division of labour whereby public scientific bodies – seen as the primary source of new knowledge – are organized in a hierarchical structure, with a linear flow of resources and information from the top to the bottom. SRI has been, however, an outstanding contribution from civil society – from farmers to the ATS to agricultural researchers. As the spread of SRI in India indicates, extension has been ahead of research in taking the innovation forward.

This has implications for the way SRI is assessed. It allows for the possibility of assessing a system instead of a technology, and helps reconfigure the debate by focusing on those linkages within the system that are weak and need strengthening or intervention. The basic hypothesis of the innovation systems framework is that the capacity to continuously

innovate is a function of linkages, working practices (institutions) and policies that promote knowledge flows and learning among all organizations within a sector. Working with some of the interesting features of the innovation system enables greater participation, as this could highlight what the research community feels are issues that need to be addressed as part of the system rather than as external critics. There are indeed several features of SRI that can answer the criticisms of agricultural research, if observed closely. For instance, the exchange of information freely by researchers with farmers, and vice versa, is one of the positive aspects of SRI in India; it is a process that has rarely been witnessed elsewhere, despite talk of participatory research within the research community.

The issues raised by SRI are not altogether new. Farmers and civil society have been at the forefront of raising issues concerning alternate conceptions of science, a cognitive element always ignored by the research establishment. They have also raised the need for a different way of looking at farming and its complexities. SRI needs to be seen by the research establishment as a dialogue point where it could contribute to newer agendas instead of criticizing it from conventional viewpoints. It presents a challenge to the scientific community at several levels, even if it has to seek alternatives to verify data where synergy and complexity are part of the assessment, instead of conventional assessments that seek to attribute changes to just one factor at a time, keeping other factors constant. Recent thinking in international agricultural research centres has pointed to the importance of “institutional learning and change” (ILAC) as an explicit recognition that traditional transfer of technology approaches to agricultural research can no longer keep pace with the complex, diverse, risk-prone and dynamic situations faced by poor farmers (Watts et al., 2003).

SRI in India is not a single story with a single message, but rather several stories with interrelated messages. Making sense of these positive experiences holds the key to improving SRI practices. The indications are that those actors and innovation champions who have intuitively appreciated this have been able to make faster progress, being better able to innovate institutionally. The small state of Tripura in the North East that has an international border with Bangladesh on three sides has shown that a greater poverty focus

and introduction of innovations need not rely on increased research inputs alone. A strategy based on integration of the extension agencies with local governmental officials and the policies of the Department of Agriculture has been more fruitful. While a late starter officially with SRI, Tripura has seen a spread of scale with several large-scale contiguous plots (in some cases as much as 65 hectares) not witnessed elsewhere in the country. That this has happened without any NGO intervention emphasizes the dynamic nature of innovation systems and the possibility that state-sector actors can play a forceful role. While Tripura needs continued technical inputs from early adapters such as Andhra Pradesh, states like Andhra Pradesh have much to learn from “laggards” such as Tripura and West Bengal about maintaining the poverty focus of the innovation and institutional innovations that can lead to scaling up. Late adopters are conventionally ignored as contributors to technological innovation, but should instead be seen as early adapters in institutional innovations.

III. Rethinking Innovation and the poor

SRI is a versatile innovation for its unprecedented ability to raise the productivity of land, labor, capital and water all at the same time. Behind this innovation is a process and new thinking about innovation. Some of the insights on innovation the case indicates are:

1. Multiple sources of innovation: SRI did not originate within the precincts of institutionalized scientific research. SRI can be considered as a civil society innovation, having been propelled mostly by NGOs, farmer organizations, and interested individuals. Civil society organizations provide a space for trying out new ideas and ways of working that would often not be permissible in mainstream research and development organizations. This case suggests a lesson for scientists as well as for extension personnel and farmers – for all to be open to new ideas, no matter what their source. The conventional thinking placing civil society organizations at the end of the innovation chain for dissemination of an already worked-out idea needs a serious rethink and has implications for innovation policy.

2. Agency of the actors: Innovations are actively shaped by the actors in the system and this includes the poor. Agricultural innovations in the past have usually benefited persons who were relatively more advantaged and well-placed compared to those who were disadvantaged more marginally located. It is the conscious choice of actors in shaping the direction of an innovation that determines whether it is pro-poor or otherwise. This was apparent in the differences in approaches of civil society and government agencies to the same innovation. One pushed for work on small and marginal farmers, and stressed important marginal productivity increases; the other focused on big farmers and super-yields. Ideas on social shaping of technology (Bijker et. al, 1987) and actor-oriented approaches (Biggs and Matsuert, 2004) are clearly of importance when dealing with the question of pro-poor innovation. Trickle-down theories are inadequate for ensuring the poverty relevance of innovation.

3. Multiple actors, multiple meanings: Following from the above is the recognition that multiple sources imply that these multiple actors imbue a particular innovation with multiple meanings. Innovations are often used by groups in particular ways to promote their philosophies, and this has to be appreciated. The meaning of an innovation is locally determined although in collaboration with actors in the local and often regional or international system. SRI has seen many local actions drawing insights from regional, national and even international experiences. The translation, however, is local. Multiple meanings of actors do present difficulties in evaluating an innovation by broadening the parameters for innovation beyond mere economic efficiency considerations.

4. Innovation champions and connectors in the spread of SRI: The initial spread of SRI was through an informal network of civil society organizations that were willing to try the approach despite the fact that it ran counter to prevailing scientific wisdom on rice production. Government research and extension organizations joined later, but SRI's spread was possible due to the efforts of one individual who was willing to face the wrath of the scientific establishment – of which he was a part – and acknowledge the potential of this approach. The other feature of the spread of SRI is that quite often champions emerged who felt obliged to promote it, not because they were involved directly in research or rice production, but just because they saw the value of the approach and felt it was important

that such an approach should at least be on the menu of option available for others to try. Two especially important driving motivations were concern for the well-being of the poor and of the natural environment.

5. Creating a culture of innovation: An important factor in the spread of SRI is the way that individual actors, from Father Henri de Laulanie to Norman Uphoff to A. Satyanarayana, and groups such as ATS, CIIFAD and other civil society organizations have worked to create a culture of innovation. The very choice of the name for the innovation, indicating a system rather than a technology, emphasizes the philosophy of innovation which places a high premium on experimentation and sharing of results. If SRI started as a civil society innovation, it continued further because a significant number of people in universities, research institutes and international organizations have made important contributions to the understanding and practice of SRI, motivated by their curiosity and good will rather by the power and authority of their institutions.

India has a variety of universities, NGOs and people's organizations that have in different states, in different ways and to different degrees taken up SRI and are soon likely to create a competitive marketplace for ideas and new technology. Sometimes (though not often) government agencies have been very much in the foreground (e.g., Tripura), perhaps the best example of SRI uptake in India owing largely to the exertions of a single individual who thinks and acts like an NGO person even though a government employee.

6. Knowledge in the Public Domain : A critical part of the innovation process is the deliberate effort by the early promoters and followed by others in placing and protecting knowledge in the public domain as part of what can be considered a "knowledge commons." This is particularly important in the context of innovation and pro-poor development, where new ideas and techniques are presented and protected as "common property" not privately appropriable, although private individuals certainly can gain private benefits from drawing on this source. This not only reduces the cost of innovation, but also plays an important role in empowering the poor in the process of innovation. It allows farmers and civil society actors to access and improve the stock of knowledge. There are

several cases wherein farmers looking for ways out of their constrained existence have found the Internet, the SRI website of Cornell University, or popular farmers' journals as providing important leads for their experiments.¹

7. Role of institutional innovations: The survival of an innovation beyond the idea stage is dependent on how actors change the norms and patterns of interaction through institutional innovations. These norms or institutions might be formal or informal. Creating a culture of innovation is dependent on establishing new norms and modifying older ones. These have been abundant in the SRI case from creating shared norms on experimentation such as trials on farmers' fields instead of in laboratories, cross-visits among farmers, and SRI proponents learning from each other (Indian scientists learning from Sri Lanka, Bangladeshi farmers and scientists visiting India, organic farmers as resource persons, etc.) as well as ensuring that ordinary labourers and not just farmers are trained. A major shift occurred in the way that innovations were seen in the making of weeders when a workshop was held outside the research establishment's network in Andhra Pradesh on farmers' fields where different kinds of weeders were demonstrated and evaluated by farmers and manufacturers. This novel institution led to several weeder designs as it enabled knowledge flows and interaction amongst the actors.

Key actors have created sharing mechanisms such as trip reports by Norman Uphoff after SRI visits to different regions. Sharing drafts with local functionaries where field visits have been undertaken, regular dialogue with farmers on SRI experiences where the pitfalls as well as benefits are discussed, and partnerships involving civil society organizations, government researchers and extensionists are all novel institutional mechanisms that have contributed to the innovation.

8. Wealth of networks: SRI is a classic example of the role and the wealth of networks (Benkler, 2006a) in enabling innovation. Existing networks, both formal such as Farmer Field Schools and organic groups such as the LEISA network, as well as informal networks such as those of Cornell alumni have often have played important roles in connecting the actors to the larger system in India including government agencies. Individuals often played

pivotal roles either in championing an innovation or an alternative innovation process, or as “connectors,” who enabled crucial knowledge flows and who often have no involvement in the alternative innovation process but want others to find out about it.

The constantly updated website on SRI by Cornell in collaboration with ATS is the best place for comprehensive technical and social information on SRI and its spread in the world. The website has several research reports and the very informative trip reports of Norman Uphoff (<http://ciifad.cornell.edu/sri/> and the more recent www.wassan.org). Apart from the above there are now yahoo groups on SRI, none as yet for India but several SRI enthusiasts from India are members of the SRI Nepal yahoo group. The idea of connectors appears in Gladwell’s (2000) popular book *Tipping Point* and explains how connectors invariably intuitively know the kinds of networks that are effective in the spread of an idea or information. Newer networks also get created when some actors and partners realize the need for maintaining knowledge flows between research and non-research actors.

9. Innovation capacity and assessing innovations: SRI was also part of a new capacity in which farmers and civil society experimentation with the SRI approach generated new research questions for the scientific community to address. Unfortunately, the scientific community did not (and, in fact, could not) recognize SRI as a dialoguing point where civil society could contribute to new research agendas. Instead, the scientific community for the most part has criticized SRI from conventional viewpoints, and has lost the opportunity to gain from a new source of ideas about science and innovation.

Building innovation capacity in a system is critical for pro-poor innovation and needs greater attention from policy-makers. Often in formulating policies, the role of institutional innovations, networks that enable knowledge flows, and knowledge dialogues are often underestimated. Neither closed networks of the poor with the poor nor of scientists with fellow scientists are likely to build resources and capabilities needed for innovation. Innovation processes involve social learning and are not stable over time. The routes, twists, surprises and outcomes cannot be predicted or mapped in advance (Berdegue, 2005).

Capacity building warrants many changes in the way innovations are assessed. Not every proposed change in agricultural practices merits much attention; however, if a possible innovation would have many benefits, it should be subjected to empirical rather than logical tests, because our scientific knowledge is not (and never will be) perfect or complete. Often we cannot judge the future of an innovation from its current incarnation given the dynamic nature of innovation processes and the understanding that knowledge need not always precede practice; on the contrary, practice can lead to knowledge (Uphoff, 2005).

SRI is still an unfinished chapter in what is a never-ending book of agricultural innovation. It shows that innovation is about providing greater choice and multiple meanings. This case has highlighted insights into the generation and use of new knowledge. The role of users in innovation is increasingly appreciated for enabling innovation (Douthwaite, 2002); user-centric approaches offer greater advantages than manufacturer-centric innovation (von Hippel, 2005); users benefit from freely revealing their innovation (Harhoff et. al. 2003). This aspect has been exemplified by discussions surrounding the open-source movement and open innovation (von Hippel 2001, Maxwell 2006).

That such ideas should be restricted to new knowledge relating to information technology is inconsistent with the case of SRI and similar such commons-based agricultural innovations (Benkler, 2006b). Here is a case of policies having much to learn from practice. Promoting innovation in developing countries for the poor needs not just the best of technology, but also innovations in policy practice. Involving the poor as users in the innovation process, as in SRI, could prevent emergence of future “innovation divides” as the poor continue to face immense challenges in a rapidly changing global environment.

Endnote:

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